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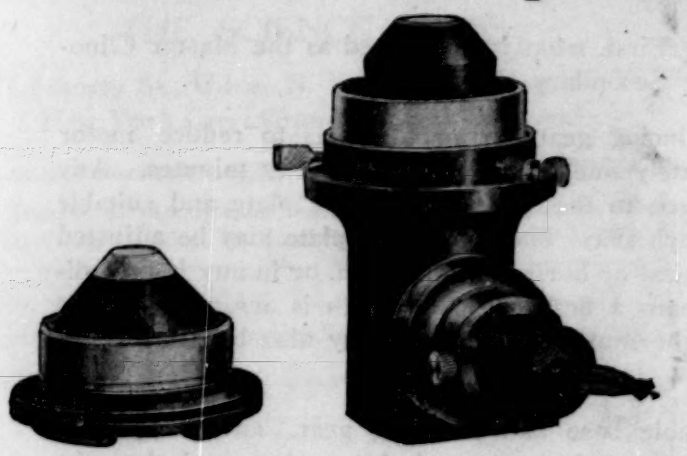

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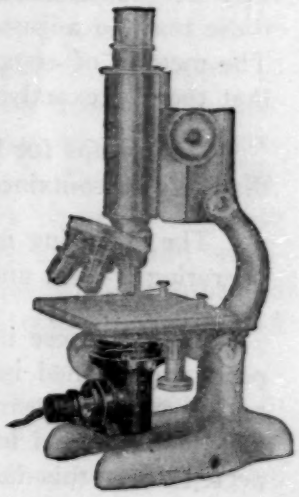

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SCIENCE OR ATHLETICS?[1]

THERE has never been a period in the history of science when educational questions relating to its advancement have appeared to possess such interest or when discussions have dealt so freely with the shortcomings of the educational system in its relation to the training of students of science. On the one hand is an intensely practical industrial world, insisting upon a close scrutiny of the content of the college courses and of the methods used in administering them,—from the standpoint of their immediate practical application to industrial problems and from this standpoint alone,—while on the other is the world of the college teacher, seeing or thinking it sees much in science and in the teaching of science that is not to be judged in this limited fashion. We are turned this way and that in the attempt to see all viewpoints and to make use of all constructive advice. We desire that our students shall be as well equipped as possible in whatever of science it is possible to teach them in the time that is allotted to us, so that when they leave us to take up their share in the general advancement of science they shall be able to acquit themselves honorably and to add whatever they may in the application of science to the problem of increasing the happiness and comfort of humanity.

Chemical education has not been spared in this discussion. Rather has it been the center of the major part of the discussion, for in no other single science has there been so spectacular and so amazing a success in research and in the tangible results of the application of research to practical problems. It has therefore come about that there is no other science in which it is more important that the college

[1] Read before the Section on Chemical Education at the Birmingham meeting, April, 1922. Contribution from the Department of Chemistry, Purdue University.

and the university shall succeed in evolving proper and effective methods for the scientific training of the youth of the land, since it is upon the mental equipment and the mental habits of our present and future students that the future of the science depends.

I propose to discuss certain phases of this subject from the standpoint of the college teacher. We respect the viewpoint of those practical men who, like Mr. Edison, feel that about the only trouble with the college graduate is that he knows nothing and is good for nothing, also of those other, perhaps broader minded, technical men who recognize the value of college training but who believe that the teachings of the class room and student laboratory are too far removed from the problems and methods of industrial applications. We also realize that some of our eminent research chemists are insisting that the college and the university should busy themselves with fundamental principles and that they should keep hands off the plant processes, while others are equally emphatic in the view that research should be more along practical lines.

Without, at present, presuming to argue any of these questions and respecting the integrity of all who offer them, we respectfully submit that in the effort of the college teacher to administer courses of training, either routine or research in purpose, there are certain factors that constantly baffle and discourage, that these factors are to a considerable extent under the control of some of those who complain of our shortcomings and even that the continuance of such conditions is directly traceable to the activities of some of the critics. This may seem to be a statement that requires justification.

I take it that every one will agree that the study of chemistry as a preparation for successful research or for work in the application of chemistry to practical problems is an enterprise that calls for the concentration and supreme effort of high grade intelligence. Any person who expects to devote merely left-over energy and surplus thought to superficial aspects of any science,—and especially of chemistry,—is foreordained to a career of attainment that is mediocre or worse. The students of chemistry of past years who consistently followed the practice of "living the life" in college, making of themselves "all-around men" by the time-hallowed practice of taking part in every possible activity on the campus and off it, except the one for which they paid their money and for which they sacrificed the best years of their lives,—these men, with few exceptions, now make up the army of fillers of small positions, doers of small things and thinkers of small thoughts. They have a certain routine part in the routine affairs of science but when they are gone their places will easily be filled by others who have followed the same line of reasoning and of conduct.

The college teacher who is dull and uninspiring in his contact with students will have a class of dull and uninspired students. This, no matter how well trained he may be or how earnestly he may desire to fulfill his mission as a teacher. But if the teacher is all that we may desire to see in a teacher:—well grounded in his subject, of broad vision and purpose, energetic, inspired and inspiring,—he may fire his students with boundless zeal for the things and deeds of science, he may grip their intellects and emotions while in the class room or laboratory, he may fill them with the highest kind of resolve for high endeavor, but he can not make true students of science of them when the whole atmopshere of the college is that of one grand hurly-burly of everything under heaven except study. Every teacher who hears this or who reads it knows that, to far too great an extent, this *is* the atmosphere of the modern American college. Some of our atmospheres are better than others,—or we might even say that some are worse than others. But when the student goes out from his session with the best teacher in the best college in the land he immediately finds himself in the midst of a multitude of distracting circumstances, events, activities and enterprises. It can not be denied that the effect of this is to lower the efficiency of the student, to weaken his mental resolve for high accomplishment and to render impotent much of the effort that has been expended by the instructor. It has repeatedly been emphasized that extra-curricular activi-

ties play a large part in the development of character and in the making of men who can deal with men. I am not denying this. Rather, I assent to it and give it emphasis. But I add, also, that the undue *multiplication* of student activities and campus side-shows plays an ever increasing part in the pulling down of the educational system with which we have labored so carefully and so painfully, and in the dissipation of the scientific efforts of those who should be our best students. Superficial training is the inevitable result and superficial training and narrowness of viewpoint are the blight of our system of scientific education to-day.

Many of our American colleges make an advertising point of the large numbers of students who flock to their doors, but I believe that it is no exaggeration to say that if we could exchange our annual crowds of graduates in chemistry, immature in intellect, unsettled in purpose and under-done in real scientific education as too many of them are, for a small fraction of this number of young men and women of good minds, well grounded in fundamentals, possessing a broader culture and accustomed to profound thinking on serious matters, the world at large and the science of chemistry would be immeasurably benefited. That we are, even now, occasionally finding some of these minds and doing something toward their proper development is cause for real rejoicing. That we might find and develop more of them if conditions were changed is a proposition that will bear examination.

What, then, is to be done about this question of the dissipation of the youthful fire of our students among the hundreds of non-essentials of college life? Change it, of course, say our critics. Exactly. And if our American colleges were now, in the truest and most complete sense of the word, "educational institutions" this would not, I verily believe, be a particularly difficult or perplexing undertaking. But, fellow scientists, our American colleges are to-day waking into the realization that they have somehow developed a *liason* with an organization that not only is not educational in its purpose,—it is actually one of the most insidious destroyers of educational standards that we have to combat to-day. This organization is no other than the modern highly commercialized intercollegiate athletic system, financed by forces that care nothing for education and fostered by extravagantly paid coaches who trample all of the ideals of education under foot in their desire for personal glory and personal profit.

There is a perfectly legitimate and desirable field for college athletics. We desire that our students shall have systematic physical exercise because this makes for health and contentment and thus, indirectly, for scholastic success. We know also that the spirit of competition is an all-powerful incentive for excellence in any line of activity and the athletic game is the logical expression of this. But this idea has become almost entirely overshadowed through the development of a system that places the vast majority of our students upon the bleachers and concerns itself with an excessive degree of specialization with an almost negligible minority. A friend of ours has tritely stated that the American people have become afflicted with a disease which he calls "bleacheritis." They find their highest enjoyment in lounging on the side lines, entertained by mediocre "movies," bad vaudeville, athletic contests or any other novel spectacle, and they take too little interest in wholesome activity on their own part or in play for the sake of its effect upon their minds and bodies. Even the hysteria of the college "pep session" accomplishes only a temporary rousing from this apathy. The result, in college life, is the almost absolute failure of physical education to accomplish any important part of its mission to keep the bodies of our students healthy and their minds alert, and to turn them back into the class room and laboratory full of vim and enthusiasm for the most important work of their education. This can not fail to work harm to the scholastic success of the student. That it goes even farther than this and that it seriously affects the educational standards of our colleges is a fact which we can not safely ignore.

Within the past few months there has been an unusual amount of discussion of the matter of professionalism in college athletics. The colleges have come in for a great deal of criti-

cism and especially in a few instances where players have been disqualified from intercollegiate competition because of having participated in games of a semi-professional nature, and where there have been exposés of the attempts of coaches and others to influence prospective student athletes by the use of money. How much may we expect to accomplish by disqualifying a few players, here and there, or by the dismissal of a coach or two for the breaking of the rules regarding the payment of money to athletes? I think that we shall accomplish very little of a remedial nature by this sort of publicity unless we go considerably farther. These published cases of professionalism in students have been largely technical in their nature and it appears evident that the students in question do not feel any consciousness of guilt nor are they regarded as criminals by their fellows. The general public probably sees little in all this but a rather fantastic exhibition of hair-splitting and quibblng by college folk, who appear to magnify a purely technical offense into a serious case of law breaking. It is probably true that the majority of non-collegiate observers,—or at least of those who take an interest in athletic affairs,—sympathize with the players who are detected in what they regard as purely technical violations of unnecessarily strict technical rules.

The principal reason for all this is that the average person does not appreciate the real evil of professionalism in college athletics. He sees nothing inherently wrong in playing for money, any more than in doing any other legitimate thing for compensation. We have professional baseball and enormous numbers of us go to see it and feel that it is perfectly proper that gate fees should be charged and that the skilled players should be paid liberally for entertaining us. Why, then, should intercollegiate associations adopt such drastic rules against college athletic professionalism and why should faculties attempt to enforce these rules so rigidly? This is certainly not done solely in order to insure fair play in intercollegiate contests.

The fact is that mere playing games for compensation, in the college or out of it, is not *inherently* immoral or wrong in any way, except as it may bear some relation to the vital concerns of the college in its efforts to promote true education. But we are insistent that the least taint of professionalism shall be kept out of our college athletics because we know that whenever we admit it we shade our scholastic standards. If petty, technical professionalism may enter then unlimited professionalism and commercialism to the last degree can not be excluded.

I am saying no more than what is fairly common knowledge when I state that there is a sort of underground activity to-day that is exerting every effort to circumvent and evade our regulations concerning amateurism. However much some of us may boast of the "cleanness" of athletics in our various colleges, we all know perfectly well that the cases of violations of the rules that are occasionally brought to light are merely the more obvious ones. We disqualify our players for participating in a summer game in a village of a neighboring state but we harbor far more serious cases of real professionalism in the boys who are provided with workless jobs, fraternity homes and other outside-financed "education" in order that they may take important places on athletic teams. These boys are hunted out while yet in the secondary schools and they are brought to college and kept there by an organized effort on the part of men who, in some cases, care nothing for educational standards or for education itself, but who know athletic excellence when they see it and who are determined to have the best of it for the college of their choice. This work is done quietly, as a rule. Occasionally some novice in the business makes a slip and an uproar ensues. This has happened on several occasions, quite recently. As a result, it is apparent to a close observer that the interests that work for commercialism are now scurrying to cover. They realize that they have been riding to a fall and in order to save intercollegiate competition from the impending wreck they have become loud in their pharisaical professions of a determination to see that the law is obeyed and that college sports are kept clean. But even in this they are careful to keep attention focused upon the

summer-playing bugaboo, so that the more serious issues are obscured.

Visualize, if you will, the college teacher,—instructor, professor, department head or dean,—making his final summary of grades for the members of his classes or sending in his mid-semester reports of delinquencies. Imagine that you see the name of one of these star athletes upon the list of those who have been found wanting. No very vivid imagination is required to complete the picture. It is quite likely that many of our teachers are upright enough and strong enough to resist the pressure which will result. Also it is quite possible that many are not so strong. This is particularly true of the teachers who hold the more subordinate positions and who feel themselves less secure in their standing. And the assault against class standards is not, by any means, confined to actual threats against individual instructors. A more subtle influence in the form of a very human and a very universal desire for personal popularity and a lurking fear of loss of dearly earned prestige finally leads to the same result. As individuals and as faculties we feel more and more strongly a timidity in the enforcement of rules,—not only rules of scholarship but rules of every description. This, I am firmly convinced, is the basic cause for the now too obvious drift of our colleges toward laxness in morale and toward the lowering of the standards of work required of those who are to receive our degrees. The futility of our most earnest efforts toward inspiring and effective teaching becomes increasingly apparent.

Fellow chemists, this is a problem which affects all of us most vitally. We have had an enormous amount of publicity for the fact that American science was not, before the war, able to cope with German science and various reasons have been assigned for this undoubted fact. The efficiency of American science was suddenly increased, during our war period, by the spur of life-and-death necessity. But this spur no longer exists and if our chemistry,—research, applied or teaching,—is to continue to hold its own we must see to it that our young college graduates go forth into the struggle fully equipped with well trained minds and hands,—well trained not only in the ability to do certain routine tasks that we have set for them in the colleges and universities, or in the ability to follow slavishly in the methods and habits of thought of their teachers, but broadly trained in scientific fundamentals, in general culture and in the ability to do independent and profound thinking on important matters of science and of life. This they do not now acquire as they could and as they should.

Whether or not you may agree with the conclusions I am about to draw, I do not believe that the essential facts as I have already stated them can successfully be denied. I do not believe that we can make any very great headway in our effort to stop the obvious decline in our standards of scientific education until we can succeed in limiting the distractions of campus activities to sane and reasonable values. We can not bring about this change until we divorce the educational system from the present commercialized system of intercollegiate athletics. And, finally, the incubus of commercialized athletics can not be shaken off until we throw out of our educational system all of our extravagantly paid professional coaches. For a fraction of a year of work we pay a football coach three or four times as much as an able and experienced professor in any other department will receive. We need not feel any surprise when we discover that he has done the best he could to earn this salary and thus to insure permanency in his position, or that he has employed every means in his power to obtain the best material for his teams, rules or no rules, and we need not expect that anything short of constant vigilance will serve to curb his extra-legal activities. His job is to develop a team that will be able to outplay the teams of approximately seven other colleges in as many contests of approximately forty minutes each, per season. He is going to do this to the best of his ability, regardless of cost, and we may think as we please about it.

Our colleges are spending relatively enormous sums upon athletic activities whose end is not, in any sense, physical development of the students but solely the winning of games and championships, while the educational needs are grievously suffering, through lack of sup-

port. This spectacle is not one that can be contemplated with equanimity by those who have faith in education and hope for its future development. We are losing the sense of perspective in educational affairs and we may not expect to elevate our colleges from a position of mediocrity in scientific training until we shall have reacquired this sense. This happy consummation is not to be attained so long as we remain in the present state of competitive hysteria or so long as we continue to provide disproportionate support for an activity that has no relation to scientific or other education except that of obstruction to it. I do not envy those colleges of the United States that are planning to sink millions in athletic stadia. I verily believe that the day will come when these colossal monuments to the suicidal folly of a so-called "educational" system will be an offense to the eyes of believers in true learning, for in that day we shall find it hard to convince our critics that we do not esteem the spectacle of two hundred and eighty minutes of actual playing of football each year as of greater importance than the training of American youth in the science of chemistry.

And now, in what way can there be any truth in the statement made in the earlier portion of this paper, to the effect that the men who are looking to the college to supply trained chemists, as well as trained scientists in other fields, are directly responsible for the continuance of this condition? Simply by this: that these people are, almost without exception, college and university alumni and that organized alumni activities concern themselves almost exclusively with efforts to further athletic successes in their colleges, to the neglect of opportunities to better educational conditions. This is certainly not because of any desire to hamper the educational work of the college. Quite the opposite is the case. They do not busy themselves so much with other modes of assistance, merely because for some reason it has not occurred to them that such assistance is possible. They believe that the college needs advertising and they have repeated so often that they nearly believe it, the old fallacy that athletic prowess is the best advertisement for institutions of higher learning.

I hope that I do not merit the appellation of "alarmist" but I do sincerely believe that the present condition and the present trend of scientific education is such as to give thoughtful people cause for concern, and I believe that we shall not get very far in our attempts to improve matters until we elect to discuss these things fearlessly and openly and then courageously to act upon our convictions. In the inspired words of Vernon Kellogg:[1] "It is incredible that in this all-important matter of getting our higher education straightened out we shall go on indefinitely acting as if we were helpless. Let the college or the university that wishes to do the greatest thing just now to be done for higher education and true learning in America step forward and boldly do the unusual thing. Let it devote the most of its energies to the most important part of its work. It will soon not be alone in its doing. It will become a prophet with honor in its own land."

The choice of courses is now ours. If we fail to exercise that choice in the name of true education and true science, we may later find that the decision has passed from our grasp. Or can it be that, as history has so often recorded of individuals, of organizations and of nations, we shall continue simply to drift until the accumulation of disaster shall shock us into realization?

E. G. Mahin

BUGS AND ANTENNAE[1]

Members of the Entomological Club of Madison, entomologists in various parts of the United States, and radio "bugs":

The Madison Entomological Club, as host,

[1] Science, 54: 19 (1921).

[1] A radio lecture given at the request of the Entomological Club of Madison, Wis., and broadcasted from the General Electric Company's station, "WGY," at Schenectady, N. Y., at 9 P.M., April 24, 1922. The transmission to Morgantown, W. Va., about 400 miles, was practically perfect, it being as distinct as though presented in a classroom. Unfortunately static or other conditions prevented it being heard at Madison, Wis., and seriously interfered at New Haven, Conn., and Wooster, Ohio.

welcomes all who listen in. It is a great pleasure in this first radio entomological lecture to be specifically authorized to convey to Madison entomologists and others the greetings and best wishes of Dr. Howard, chief of the Federal Bureau of Entomology, Dr. Gibson, Dominion entomologist of Canada, and the presidents of the older entomological societies on the eastern coast, namely, Cambridge, New York, Brooklyn, Washington and Philadelphia, the last founded in 1859, the oldest of its kind in the country and with its founder, Ezra T. Cresson, still active. The pioneer and veteran entomologist of Canada, Dr. Bethune, has authorized the extension of his congratulations and best wishes to present day workers. We would also express our appreciation to the General Electric Company of Schenectady for placing this lecture upon its program.

There are great possibilities in broadcasting and, for the purpose of determining its present value, the speaker requests reports by mail giving the number of entomologists at each unit receiving this lecture. Crop and market reports are broadcasted. Why not warnings of insect depredations? Regional programs and lectures by visiting specialists are very desirable present day possibilities.

This has been called the age of man. Is it not really the age of insects? They occur almost everywhere. They actually imperil our existence by attacking crops, destroying forests, annoying and worrying domestic animals, and are well known carriers of deadly infections, such as typhoid fever, yellow fever, cholera and sleeping sickness. Were it not for the beneficent activities of birds and many other natural agents, we would be overwhelmed by the numerous pests contemptuously designated as bugs. There are in New York State some 20,000 different species of insects and perhaps 100 entomologists engaged in collecting and studying them. There are presumably more than 100,000 species in the United States with over 1,000 entomologists and in the entire world a million to ten million different species of insects (a large proportion unknown) and a relatively much smaller group engaged in their study. Each of these insects occurs in four distinct stages, namely, the egg, the maggot or caterpillar, the pupa or chrysalis and the adult or perfect insect, consequently the entomologists of the world are engaged in the stupendous task of classifying and learning the habits of four to forty million different forms. Accurate differentiation must precede investigation of life histories, otherwise deplorable confusion is almost inevitable. There is no group in the animal, the vegetable or the inorganic kingdoms which presents so many diversities as the exceedingly numerous and varied forms known as insects. It usually takes several years and frequently much longer to work out a satisfactory life story of even one insect, consequently a limitless field is before us. We extend to radio "bugs" and others interested an invitation to join in exploring and making known this vast realm of the undiscovered.

Man is inclined to congratulate himself upon his wonderful progress, forgetting that in many cases he has yet to reach the degree of perfection seen in numerous animals. The recently developed monoplane, for example, does not differ greatly in its general proportions from those of our hawk moths, and the biplane is almost a duplicate of a pair of dragon flies, one flying above the other; both models that have been favorites in the insect world for thousands of years. Dare any man say that our latest advancement in applied science, namely, the radio telephone, is more than a relatively crude modification of methods which have been used by insects for countless ages?

Radio "bugs" are rightfully proud of their aerials or antennæ, yet they have developed relatively few types and apparently have not learned, except in a very general way, of the million or more different kinds of insect antennæ, each admirably adapted to a specific purpose and some wonderfully suggestive of aerial communication.

Ages ago the gall midges, minute flies which produce galls on many plants, learned the advantages of elevated or elongated antennæ and we find here species which have solved the problem by the development of greatly elongated antennal segments, thus increasing very materially the length of the entire organ and others which have attained the same end

through a doubling or trebling of the normal number of segments or joints. As a result, some have antennæ twice as long as the body. Each segment is a unit and though the comparison may not be a strictly accurate one, we are inclined to regard the antennal segments as linked in multiple units.

It is well known that the antennæ of many insects have very efficient olfactory and auditory structures. The latter may be simple hairs springing from sensory pits, whorls of hairs or even more complex structures.

The radio enthusiast would certainly be interested in an aerial or antenna of the multiple inverted umbrella type, the arms of the umbrellas being loops and in some forms greatly extended on one side, presumably for directive receiving; the umbrellas arranged in double or triple series in multiple units mounted with flexible connections and an articulate base permitting limited rotation. Such structures are found in gall midges.

We would call attention to the peculiar circumfila or encircling threads supported by numerous short stems entering sensory pits or detectors, the latter within the antennal segments. The simplest type of circumfilum is a low thread or circle, not a coil, near the base of the segment and frequently connected by a filament on one face with a similar circle near the opposite extremity. These threads may be modified and follow a sinuous or wavy course instead of a straight one; they may be greatly increased in number to form an enclosing net work, suggestive of the bed spring aerial; the portions between the supporting stems may be greatly stretched or drawn out as it were to form relatively enormous loops and in some we have the loops on one side of the antennæ very greatly produced. We may even find in some antennæ a combination of the low and simple type together with highly developed loops. There is one group where these structures are modified in such a curious way as to resemble miniature horse shoes upon opposite sides of each segment; the supporting stems suggesting the nails used for the attachment of horse shoes.

There are over a thousand variations in gall midge antennæ, presumably for cause. Solomon advised some of his fellow mortals to consider the ant. May we suggest to radio enthusiasts a similar attitude toward gall midges—master builders of antennæ which are both the admiration and despair of man.

Concluding, may we register faith in radio and radio antennæ, anticipating through them closer and more helpful relations with fellow men.

E. P. Felt

State Entomologist
of New York

JOHN CASPER BRANNER

The following resolution was passed at a meeting of the Academic Council of Stanford University held April 7, 1922:

As witness of our affection for Dr. Branner and respect for his memory, we desire to make our own and incorporate (in part) in the minutes of the Academic Council the appreciation prepared for the *Illustrated Review* by his friend and colleague, Professor Stillman:

"In the death on March first of President Emeritus John Casper Branner, Stanford University loses one of its most distinguished scholars, one of its greatest teachers and most respected and beloved personalities.

"Dr. Branner was born in New Market, Tennesee, on July 4, 1850. He attended school at Maury Academy in Dandridge, Tennessee, and later enrolled at Maryville College. At the age of eighteen he entered Cornell University, where he received his bachelor's degree.

"While still an undergraduate he was selected (1875) by Professor Charles F. Hartt to assist him in a geological survey of Brazil, which occasioned several years of work in Brazilian geology. In 1882 he was again commissioned, by the United States Government, to go to South America to investigate insects injurious to cotton and sugar-cane industries. From 1883 to 1885 he was engaged by the Pennsylvania Geological Survey to make a topographic map of the Lackawanna Valley.

"When David Starr Jordan became president of the University of Indiana in 1885, he appointed his Cornell college and fraternity mate to the professorship of geology at that institution, a position he held until again called by Dr. Jordan to the similar chair in Stanford University. In the meantime he acted (1887-1892) as state geologist of Arkansas, while retaining his chair at Indiana.

"From 1891 until his retirement from the uni-

versity in 1915, Dr. Branner occupied the headship of the department of geology and mining, holding also the office of vice-president of the university from 1898 to 1913. Upon the creation of the title of chancellor for Dr. Jordan, in 1913, Professor Branner was elected president, a position which he held until January, 1916, when he also retired under the age limit established by the university, and became president emeritus. During his years of service at Stanford, Dr. Branner found occasion to direct or participate in professional missions, such as his expedition to Brazil under the patronage of Alexander Agassiz in 1899, and again in 1907-1908. He was also one of the special government commissioners on the Panama Canal, and on the California earthquake of 1906.

"The scientific service of Professor Branner has been widely recognized. He was a member of the National Academy of Sciences, the American Philosophical Society, was president (1904) of the American Geological Society, vice-president (1890) of the American Association for the Advancement of Science, held membership in the Geological Societies of London, Edinburgh, France, was president (1911) of the American Seismological Society, and was a member of geologic and geographic societies of several Brazilian states and of other countries. He has received the degrees of Ph.D. from Indiana University in 1885, of LL.D. from the University of Arkansas in 1897, from Maryville College in 1909, and from the University of California in 1915, and the degree of Sc.D. from the University of Chicago in 1916.

"His publications are numerous and, while the great majority are on geology, many evidence the breadth of his active interests in botany, entomology and other lines of natural sciences. His grammar of the Portuguese language (now in its fourth edition) grew out of his Brazilian experience. His bibliography of Clays and Ceramics, an important compilation; the "How and Why Stories," a charming collection of southern negro dialect myths (1921); his genealogy of "Casper Branner of Virginia and His Descendants"; and his recently completely but as yet unpublished translation from the Portuguese of Alexandre Herculano's *Establishment of the Inquisition in Portugal*, all evidence his breadth of interests and his tireless energy.

"As a teacher Professor Branner exerted upon his students an influence which inspired them to their best efforts. His broad experience, his own sytematic and untiring research, his realization of the supreme importance of practical experience as the final test of all theories, were well calculated to stimulate the ability and energy of his students, while his simple, sincere, and sympathetic personality attached them to him with a rare devotion."

Dr. Branner's attitude toward the office of president was characteristically expressed in his inaugural address:

"I am here to serve you in every way in my power and in everything that pertains to your work as instructors in the university and as scholars interested in your own special lines of work. I expect and I intend to be the servant of every member of this faculty except myself. I consider the support I can give you my most important duty, and it will be my greatest pleasure."

In becoming president of the university, Dr. Branner did not cease to be teacher and colleague. He made the problems of all the departments his own. In his relations with students and faculty the informality of attitude and high courtesy were unchanged. He maintained the same dignified simplicity he had exhibited as executive head of his department.

Dr. Branner's life is a great heritage for Stanford University, for California, and for the nation.

RAY LYMAN WILBUR,
President

SCIENTIFIC EVENTS

A COUNT OF BIRDS

RENEWED interest in the bird population of the United States has led to a revival of the efforts, begun in 1914, by the Biological Survey of the United States Department of Agriculture, to collect information on the number and distribution of the birds breeding in this country. Counts have been made each succeeding year, and interested persons who are thoroughly familiar with the breeding birds of their respective vicinities are asked to aid in the work. By continuing these counts over a period of years and counting the same areas each year, knowledge can be gained not only of our total bird population but also of its fluctuations from year to year. The counts, moreover, will greatly help in determining what effect the present state and federal laws have on the increase of game and insectivorous

birds. The department hopes that counts will be continued on all land where they have previously been made, and it especially desires to obtain also series of counts indicating the bird life on the plains; on the deserts, both with and without irrigation, and in the southern and western states.

It might be well to select new areas where physical conditions are not likely to change much for a number of years, so that if succeeding annual counts show changes in bird population it will be known that they are not due to changed environment brought about by man. On the other hand, there is much to be learned regarding the adaptation of birds to changes of environment; any area therefore on which reports can be made year after year may be chosen, even though conditions are likely to change. Possible inability to repeat a count on the same tract need not, however, deter any one from making the count this year.

The height of the breeding season should be chosen for this work. In the latitude of Washington, D. C., at latitude 39 degrees, May 30 is about the right date for the first count. In the latitude of Boston the work should not begin until a week later; while south of Washington a date still earlier than May 30 should be selected. The department wants to learn how many pairs of birds actually nest within the selected area. Birds that visit the area only for feeding purposes must not be counted, no matter how close their nests may be to the boundary line.

Several kinds of counts are needed for a study of the relative abundance of birds under changing and stationary conditions. It is hoped that many persons interested in bird life will make one or more counts this season. If only one count is made, the tract selected should represent average farm conditions for the locality, should not have an undue amount of woodland or orchard, and should contain not less than forty acres a quarter of a mile square nor more than eighty acres. If there is an isolated piece of woodland of from ten to twenty acres conveniently near, a separate count of the birds nesting there will be useful in addition to the count on the rest of the farm. In this case the report, in addition to specifying the size and exact boundaries of the area, should give the principal kinds of trees, and whether there is much or little underbrush.

A third count is desired of some definite area of woodland, which is part of a larger timbered tract. Still a fourth count, supplementary to these is needed. The average farm in the northeastern states contains about one hundred acres, and the average count hitherto has been of the birds nesting on the fifty acres of the farm nearest to and including the farm buildings. It is now necessary to obtain counts also of the remainder of the farm, the wilder part containing no buildings, especially on the same farms where counts about the buildings have already been made. Besides these, counts on any other kinds of land are much desired for comparison.

Any one who is willing to do this work is requested to send his name and address to the Biological Survey, Washington, D. C. Full directions for making a count and report blanks will be sent in time for plans to be made before the actual time for the field work. Since the bureau has no funds with which to pay for this work, it must depend on the services of voluntary observers.

THE CHEMICAL EXPOSITION[1]

THE Eighth National Exposition of Chemical Industries will be held this year in the Grand Central Palace, New York, during the week of September 11 to 16, inclusive. It will follow immediately upon the fall meeting of the American Chemical Society. The early date will give college and university men an opportunity to see the exhibits before the beginning of the college year. There is much in this coming exposition to interest university men. Each floor has exhibits of laboratory apparatus, and one floor has a considerable group of this type of equipment. Many new pieces of apparatus, new chemical compounds, and other material and instruments will be found here.

The interests for industrial chemistry in the exposition are wide and varied: from raw materials in minerals, ores, manufacturing crudes or by-products, through the range of ma-

[1] From the *Journal of Industrial and Engineering Chemistry*.

chinery, apparatus and equipment and instruments for control, precision, recording, gaging and measuring, and a thousand other items used in converting the raw materials into the finished products. The finished products themselves, whether they be organic, inorganic, solid, liquid, gaseous, or of any other form, are all to be there. Many new things upon which manufacturers were working when the war ended and which have been more leisurely perfected since will be shown for the first time. Industrial progress continually calls for greater advancement and perfection in manufacture, and each year sees many notable improvements upon the exhibits in the exposition. Counting only these, the time of technical and business men is well spent in inquiring into the exhibits. One exhibitor, who for the past few years has been devoting time to the perfection of a new form of apparatus, said the other day that it is now when men have time to spare for consideration of these things that he expects a considerably larger and more interested attendance in his booth. "When the plants are idle as they are now, the most progressive companies are examining into our apparatus, and a remarkable thing is that we are making some installations in plants which are now closed, so that when they begin work they will be in better position than ever and have an advantage in taking this opportunity to prepare to reduce their costs for the future. I'm looking for many more such openings through our exhibit and with considerable enthusiasm for the entire exposition."

The managers report that three full floors of the Grand Central Palace are already taken for the exposition and a part of a fourth. They expect all space will be engaged before the opening date. Already, 303 exhibitors have contracted for space.

The exposition will contain two interesting special sections: one upon the subject of fuel economy, where exhibits intended for the more efficient use of fuel, its combusion, distribution, or control will be made. The other will deal with shipping containers, including the container itself, whether of metal, wood, fiber, paper, glass or in cooperage products of slack and tight barrels, tanks and towers, and with machinery for packaging, labeling, handling, and conveying the packaged material and marking it ready for final shipment.

Work upon the program has not yet been actively undertaken but it may be expected to compare more than favorably with the high standards of the preceding expositions. The management have returned to the Grand Central Palace with their offices, and all inquiries should be directed there.

FELLOWSHIPS IN MINING RESEARCH

THE cooperative department of mining engineering of the Carnegie Institute of Technology, Pittsburgh, announces the offer of two fellowships in mining research, and two in teaching and research, in cooperation with the Pittsburgh Experiment Station of the United States Bureau of Mines. The fellowships are open to the graduates of universities and technical schools who are properly qualified to undertake research investigations. The value of each fellowship is $750 per year of ten months beginning on July 1 for the position of research fellow and on August 1 for teaching fellow.

Investigations will be on the following subjects: (1) Acid Mine Waters: (*a*) physical-chemical study of the mechanism of corrosion in acid mine water; (*b*) neutralization with limestone, blast furnace slag, etc.; (*c*) recovery of iron oxide for gas purification and other purposes; (*d*) purification for use in boilers. (2) Shooting Coal: (*a*) factors in shot firing which favor the production of lump coal; (*b*) effect of location, size, and depth of bore holes; (*c*) kind of explosive; (*d*) sequence of firing; (*e*) method of charging and firing; (*f*) method of cutting coal. (3) Spontaneous Combustion and Coal Storage: (*a*) effect of size of coal; (*b*) effect of moisture; (*c*) effect of anthraxylon and attritus; (*d*) action of various forms of sulphur. (4) Geology: (*a*) relation of relative proportions of anthraxylon and attritus in coal to its coking properties and by-product yield; (*b*) correlation of coal seams by microscopic characteristics; (*c*) constitution of coal seams in western Pennsylvania. (5) By-products Coking: (*a*) determination of the heat of carbonization of coal; (*b*) determina-

tion of the volatile matter in coke at various temperatures. (6) Utilization of Coal; (*a*) study of the economic utilization of the roof coal of the Pittsburgh seam, including structure, composition, coking properties, and by-product yields. (7) Coal Mining: (*a*) determining the compressive strength of coal from various beds.

All the time of the research fellow is to be devoted to work in the Experimental Station of the U. S. Bureau of Mines which is located adjacent to Carnegie Institute of Technology. The position of teaching fellow includes ten hours each week devoted to teaching work in mining, and the balance to work in the Experimental Station.

EXCHANGE PROFESSOR TO FRANCE IN ENGINEERING AND APPLIED SCIENCE

Dean John Frazer, of the Towne Scientific School of the University of Pennsylvania and professor of chemistry, has been chosen as exchange professor to France for the coming academic year, by the committee on exchange with France of professors of engineering and applied science, representing Harvard, Yale, Columbia, Cornell, Massachusetts Institute of Technology, the Johns Hopkins and the University of Pennsylvania.

The movement for the annual exchange with France of a professor of applied science had its origin as the result of a letter written shortly before his death by the late President Richard Maclaurin, of the Massachusetts Institute of Technology. The French administration responded very cordially to the offer for the annual exchange of a professor and selected for their first representative Professor Jacques Cavalier, rector of the University of Toulouse, and a well-known authority on metallurgical chemistry, who divided his time during the current academic year among the seven cooperating institutions, namely, Columbia, Cornell, Harvard, Johns Hopkins, Massachusetts Institute of Technology, Pennsylvania and Yale.

The American universities selected as their first outgoing representative for the first year Dr. Arthur E. Kennelly, professor of electrical engineering at Harvard University and the Massachusetts Institute of Technology. He has met with great success in his undertaking in France, and in addition to lecturing before numerous French technical schools was assigned by the French educational authorities, through M. Petit Dutaillis, minister of public instruction in France, to spend several weeks at the Universities of Paris, Grenoble, Lyons, Marseilles, Toulouse, Bordeaux, Nancy and Lille, giving in each a course of lectures, some technical and others of a more general character.

Dean Frazer in the course of his work of lecturing in French before the various universities and scientific societies of France, will have favorable opportunities of studying at close range French educational methods, especially as applied to science.

Dr. Frazer represents the fourth generation to be graduated from the University of Pennsylvania, and the third generation to be connected with its faculties. His grandfather, John Fries Frazer, from 1844 till his death in 1872, was professor of natural philosophy and chemistry in the University of Pennsylvania and vice-provost from 1855 to 1862. He was one of the incorporators of the National Academy of Sciences in 1863. His father, Dr. Persifor Frazer, became professor of chemistry in 1872, which chair he held until his appointment to the Second Geological Survey of Pennsylvania. He died in 1909. Dr. John Frazer was born in Paris, France, on February 5, 1882. In 1904 he was appointed instructor in chemistry, being later promoted to assistant professorship and subsequently to a professorship. In 1912, upon the reorganization of the old college, he became dean of the Towne Scientific School, which position he has held since, except while on leave of absence when in the service in 1918.

SCIENTIFIC NOTES AND NEWS

Sir Auckland Geddes was given the honorary degree of doctor of laws by the University of California at the recent Charter Day exercises celebrating the fifty-fourth anniversary of the university. The British ambassador was the main speaker on Charter Day, the subject of his address being 'Some of the effects

of increasing scientific knowledge upon constitutional government."

ON May 1 a number of the friends of Colonel Fielding H. Garrison gave a dinner in his honor in Washington. Dr. Harvey Cushing presided and Dr. William H. Welch gave an account of Dr. Garrison's work in medical history and bibliography. Dr. Garrison will leave shortly for work in the Philippines.

PROFESSOR FREDERIC S. LEE, of Columbia University, has been elected vice-president of the International Association of the Institut Marey of Paris.

To fill the place of the correspondent in geometry in the Paris Academy of Sciences, vacant by the death of Professor Noether, of Erlangen, M. René Baire, of Dijon, has been elected.

THE Bessemer Gold Medal of the British Iron and Steel Institute for the year 1921 has been awarded to Mr. Charles Fremont, in recognition of his services in the advancement of the metallurgy of iron and steel and the technology of the testing materials.

AT the fifth annual meeting of the British Society of Glass Technology held on April 26, Professor W. E. S. Turner was elected president.

DR. A. PULLE, professor of systematic botany in the University of Utrecht, Holland, has become director of a second botanical garden presented to the university by the heirs of the late August Janssen, who founded his garden in 1905 near his country residence about fifteen kilometers from Utrecht.

DR. L. R. WILLIAMS, formerly deputy commissioner of health of New York State and for the last four years director of the Rockefeller Commission on the Prevention of Tuberculosis, has been appointed managing director of the National Tuberculosis Association in the place of Dr. Charles J. Hatfield, of Philadelphia, who resigned to give most of his time to tuberculosis work in Philadelphia.

ON May 1, R. T. Stull was relieved of the superintendency of the Ceramic Experiment Station of the Bureau of Mines at Columbus, Ohio, and made supervising ceramist for the bureau as a whole. He will act under the direction of the chief mineral technologist and will have supervision in technical matters in ceramics, and such related investigations of nonmetallic minerals as may from time to time be assigned to him.

E. R. SHEPARD, known for his work in electrolysis at the Bureau of Standards, has resigned to engage in private practice.

THE Universities of Melbourne, Sydney and Adelaide have united to invite Professor Einstein, should he visit Java, to continue afterwards to Australia and visit the principal cities.

O. P. Hood, chief mechanical engineer of the Bureau of Mines, will spend the summer in Europe investigating recent developments in fuels.

DR. R. B. MOORE, chief chemist of the Bureau of Mines, sailed on May 6 for England, preparatory to spending two months in various European countries for the purpose of obtaining data on chemical and mineral technology. Dr. Moore will visit England, Germany, France, Austria, Czechoslovakia, Holland and Belgium.

DURING the summer Messrs. C. O. Peak, O. A. Plunkett, C. L. Porter and P. A. Young will be employed in plant disease survey work in the State of Illniois. This survey is under the general direction of Professor F. L. Stevens and under the special direction of Mr. L. R. Tehon.

THE committee on the C. M. Warren Fund of the American Academy of Arts and Sciences voted the following grants at its meeting held on May 4: $500 to Professor C. James, New Hampshire College, to assist a research on the ytterbium earths; $500 to Professor Charles A. Kraus, Clark University, to be used to continue his investigations on the constitution of metallic substances. Applications for grants should be made to the chairman of the committee, Professor James F. Norris, Massachusetts Institute of Technology, Cambridge, before the next meeting of the committee, which will be held on October 1.

PROFESSOR WILLIAM H. HOBBS, of the University of Michigan, gave a lecture at the Sorbonne, University of Paris, on April 29, on

"Les guirlandes insulaires du Pacifique et la formation des montagnes." On May 1 he lectured at the University of Grenoble. Professor Hobbs has now sailed for the West Indies and South America, with the intention to return to Ann Arbor at the end of August.

DR. IRVING LANGMUIR, of the General Electric Company, spoke before the Delaware section of the American Chemical Society in Wilmington on April 19 on "Molecular structure and its relation to chemical valence."

PROFESSOR H. A. WILSON, of the Rice Institute, Texas, will lecture at the summer session of the University of Chicago on "The electrical properties of gases."

THE following public lectures will be given at University College, London, during the present term: "Atoms, molecules and chemistry," three lectures by Sir J. J. Thomson; "Insects and disease," four lectures by Sir Arthur Shipley; "Recent discoveries in Egypt," by Professor Flinders Petrie; and "The expansion of European civilization," four lectures, by Professor W. R. Shepherd, of Columbia University.

THE Linacre Lecture of the University of Cambridge was delivered on May 6 by Sir Humphry Rolleston, on the subject of "Medical aspects of old age."

The *Journal* of the American Medical Association states that the National Academy of Medicine of Venezuela has decided to hold a celebration of Pasteur's centenary. A prize, consisting of a gold medal and 2,000 bolivares, will be granted to the author of the best work presented. A portrait of Pasteur will be placed in the assembly room of the academy and a special medal will be engraved.

The sixteen hundred volume library of the late George Trumbull Ladd, professor of moral philosophy and metaphysics at Yale University, has been given to the Hatch Library of Western Reserve University. Professor Ladd was a graduate of Western Reserve College in the class of 1864.

CARL LUMHOLTZ, born in Norway in 1851, formerly engaged in anthropological exploration and research for the American Museum of Natural History and other institutions, died at Saranac Lake, N. Y., at the beginning of the present month.

SIR ALFRED PEARCE GOULD, late vice-chancellor of the University of London, and president of the Medical Society of London and of the Röntgen Society, died on April 19 at the age of seventy years.

PROFESSOR RENÉ BOHN, a director of the Badische Anilin u. Sodafabrik, and one of the pioneers of the German coal-tar dye industry, has died at the age of sixty years.

THE death is announced of Dr. Isoji Ishiguro, the Japanese engineer.

THERE will be a meeting of the Society of Plant Physiologists with the American Association for the Advancement of Science at Salt Lake City from June 22 to 24. Papers to be presented before the physiological section should be mailed to E. T. Bartholomew, School of Tropical Agriculture, Riverside, California, before June 1.

OWING to serious flood conditions of the Mississippi River, the annual meeting of the American Oil Chemists' Society, which was to have been held at the Grunewald Hotel, New Orleans, on May 8 and 9, has been postponed to June 5 and 6 at the same place.

THE alumni members of Sigma Xi of Southern California held a meeting on the evening of May 24, at the Norman Bridge Laboratory of Physics, Pasadena, California, and organized the 'Sigma Xi Club of Southern California." About fifty members, representing sixteen institutions, were present. The following officers were elected: Dr. W. L. Hardin, Los Angeles, *president;* Dr. Paul W. Merrill, Mt. Wilson Observatory, Pasadena, *secretary;* Dr. E. E. Chandler, Occidental College, *treasurer.* There are more than a hundred alumni members of Sigma Xi in Los Angeles, Pasadena, and near-by towns.

THE British Institute of Physics, of which Sir J. J. Thomson is president, has arranged for the delivery of a course of public lectures with the view of indicating the growing importance and place which physics now holds in industry and manufacture. The first of these lectures was delivered by Professor A. Barr of

Glasgow, on April 26, in the Hall of the Institution of Civil Engineers.

AT a meeting of the advisory council of the Phipps Institute, Philadelphia, April 29, gifts totaling $150,000 were announced. The sum of $25,000 will be given yearly for five years by the Carnegie Corporation, for research purposes. Dr. Josiah H. Penniman, acting provost of the University of Pennsylvania, stated that the board of trustees had voted $25,000 to be given during the next two years to the institute. The family of Henry Phipps announced that they pledged $500,000 to the endowment fund, provided an additional $2,500,000 be raised.

THE fund for the establishment of the Harvard School of Public Health will be entitled the Henry Pickering Walcott Fund in honor of the senior member of the Harvard Corporation. As has already been announced, the Rockefeller Foundation has agreed to contribute at once $1,500,000 and eventually $500,000 in addition; these amounts will be increased by a fund of $1,000,000 provided by the university and also by the income of more than $3,000,000 which is now being expended by the university in various departments which will be incorporated in the school. It will probably open next year for instruction and research in the field of public health. It will be closely allied to the Harvard Medical School, and Dr. David L. Edsall will serve as dean of both schools. Certain departments now organized under the Medical School, such as those of industrial hygiene and tropical medicine, will become part of the new school, which will also develop and enlarge the work of the School of Public Health now jointly conducted by Harvard and the Massachusetts Institute of Technology.

THE Board of Research Studies of the University of Cambridge, in a report on the admission of research students, records that steps have been taken to concentrate in the board the power of admission of research students, and it is hoped that this will tend towards the preservation of a uniform standard of qualification. Secondly, they record that it has been decided to institute the degrees of M.Litt. and M.Sc. The regulations for these degrees appear in the current number of the *Reporter*. The number of research students admitted when the last report was presented was 72. Since then 71 have been admitted, making in all 143. These figures, however, hardly represent the comparative number of admissions this year and last, for at the beginning many already at work under the old regulations for the B.A. degree were permitted to transfer. During the year two students withdrew their names. The proportion of Cambridge graduates among the students now admitted has risen. The large number of graduates of other universities within the British Isles remains a feature. Those from Canada and the United States are fewer than may be anticipated when the degree is better known, their combined number—25—being approximately that of those coming from the Indian Empire.

THE British Board of Trade has issued an order exempting certain German scientific and other periodicals from the provisions of the German Reparation Act of 1921. Any article is exempted "being a publication in the German language which is proved to the satisfaction of the commissioners of customs and excise to be a periodical publication of a German learned society, or other scientific or philosophical periodical publication."

UNIVERSITY AND EDUCATIONAL NOTES

PROFESSOR EDWARD H. ROCKWELL, after twenty years of service on the faculty of the Engineering School at Tufts College, has accepted a call to Rutgers College to be dean of the Engineering School.

ANNOUNCEMENT is made by the Rensselaer Polytechnic Institute that Professor Edwin A. Fessenden, of Pennsylvania State College, will become, at the beginning of the next collegiate year, professor and head of its department of mechanical engineering.

PROFESSOR HERBERT R. MOODY, for seventeen years connected with the department of chemistry of the College of the City of New York as professor of industrial chemistry and chemical engineering, has been appointed director

of the department to fill the vacancy caused by the death of the late Professor Charles Baskerville.

Dr. George Dock has resigned his position as professor of medicine at Washington University Medical School, St. Louis.

At Columbia University, Dr. James P. Southall, physics, and Dr. James Kendall, chemistry, have been promoted to professorships. Dr. Robert H. Bowen, zoology, Dr. Roy J. Colony, geology, Dr. John A. Northcott, mathematics, and Dr. Hugh Findlay, agriculture, have been promoted to assistant professorships.

Promotions in psychology and educational psychology at Columbia University are announced as follows: At Barnard College, Dr. H. L. Hollingworth to a full professorship; at Columbia University, Dr. A. T. Poffenberger to an associate professorship; at Teachers College, Dr. Arthur I. Gates, Dr. William A. McCall and Dr. Leta S. Hollingworth to associate professorships.

Dr. Edwin G. Boring and Dr. Herbert S. Langfeld have been appointed associate professors of psychology at Harvard University. Dr. Boring has since 1919 been professor of experimental psychology at Clark University. Dr. Langfeld has been promoted from an assistant professorship.

DISCUSSION AND CORRESPONDENCE

DECEREBRATION IN BIRDS

The recent observations of Shaklee[1] on decerebrate pigeons serve to emphasize some features of the physiology of the central nervous system of special interest to workers in this line. The long period of survival—nearly twelve months—and the new features of decerebrate behavior recorded, again call attention to the possibilities of this method of experimentation as well as to some of the dangers of its interpretation.

The positive result of the return of the drinking reaction, not hitherto obtained in similar work, points to a greater flexibility in the neural mechanism than we have usually ascribed to it and falls into line with some of the newer conceptions that have been gaining foothold in the field of brain function. Whatever interpretation of the results may be made regarding the process by which such restoration of function is accomplished, everyone must be impressed by its extent and adaptative importance.

The differences between the present work and the results of Martin and Rich[2] to which Shaklee refers deserve a word of comment. Aside from the difference in species used, which may or may not have influenced the results, it should be emphasized that Martin and Rich operated on newly hatched chicks, thus excluding the influence of individual habit or experience prior to decerebration, while Shaklee used adult pigeons. Another factor is the distinctly longer period of survival in the pigeons.

The highly speculative interpretation placed upon these very interesting results may be passed over with the exception of one or two points. It seems surprising that, if the arc upon which the drinking reaction depends is of the deeply ingrained type postulated, it did not show activity for 32 days. In considering the feeding reaction the importance of taste seems strangely overstressed. A hard grain in the tip of the beak could give rise to very little more taste than do the bits of gravel which are also normally swallowed by birds.

The interpretation of work of this nature must be cautious. The facts of re-education (I use the term without implication as to the method by which restoration or substitution is accomplished) in man and animals show that many things can be done which are never normally done in the lives of the vast majority of the individuals or of their ancestors. As when storms damage telephone and telegraph lines, communication can be effectively established by routes never normally used, so in the nervous system possible and efficient arcs and

[1] *Am. Journ. Physiol.*, Vol. lv, p. 65, 1921.

[2] *Am. Journ. Physiol.*, Vol. xlvi, p. 396, 1918.

pathways may exist which are never normally traversed.

Only one explanation of the restoration of function is offered in the article under consideration, *i. e.*, that the subcortical arcs are the more primitive and are sufficiently retained in adult pigeons after decerebration to make possible the carrying out of normal drinking reactions.

Another explanation is also possible. Many writers have claimed that certain habits, arising in the first instance through activities involving the cortex, later are passed on completely to subcortical centers. As Herrick[3] points out, these acquired automatisms may so closely resemble inherited reflexes as to be indistinguishable in the absence of the history of their development. If it is here assumed that the drinking reaction established during the life of the pigeon is transferred in large part to subcortical structures, its retention after decerebration would seem to be expected, while in the case of the chick, decerebrated before such reactions were built up, no such appearance could be looked for. It might also be argued that the feeding reaction, being more complicated, was not so completely transferred from the cortical region as to be effective after decerebration.

That such an assumption may be justified is indicated by the work of Franz and Lashley[4], who found from numerous careful experiments with white rats that extensive cortical lesions did not usually affect the retention of most habits due to previous training, nor did they prevent the formation of new habits. The authors also report that in the cat and monkey where the frontal portion of the cortex is normally utilized in the formation of certain habits, these habits, if long practiced, are still carried out in the ordinary way after the ablation of the frontal cortex. This work as well as its continuation by Lashley[5] clearly shows that the classical picture of the decerebrate animal is in large measure erroneous and must be carefully revised and with it the entire conception of the physiology of the central nervous system. Any contribution to this promising and important field is to be welcomed.

FRANK W. WEYMOUTH
STANFORD UNIVERSITY,
CALIFORNIA

[3] *Introduction to Neurology*, 2d ed., p. 336.
[4] *Psychobiology*, Vol. 1, p. 71, 1917.
[5] *Psychobiology*, Vol. 2, p. 55, 1920.

THE BITE OF LACTRODECTUS MACTANS

IN SCIENCE for January 13, F. R. Welsh writes on "Poisonous Spiders." In regard to the "Black Widow," *Lactrodectus mactans*, he quotes Dr. McCook as of the opinion that the bite of this spider is "in most instances of small consequence." During the past two years the writer has had called to his attention four cases of attacks by this spider on human beings. These were all reported by practising physicians who sent in the spiders for identification. All four cases were those of men who were bitten on the penis while using outside closets. In every case the results were of a very serious nature. The patients suffered intense pain accompanied by severe abdominal disturbances, convulsions and delirium. In one case the abdominal pain was so intense and pronounced that the patient who had been sent to a hospital in a distant city was, upon arrival, promptly operated upon for appendicitis. The severe symptoms lasted from twenty-four hours in one man to over a week in the case of another. In a third case the physician reported four days after the patient had been bitten that he was "not yet out of danger." However all ultimately recovered. Two of these men were bitten the same day in the same closet and presumably by the same spider, indicating that the spider does not exhaust her venom by one bite.

These experiences would indicate that the bite of this species, at least when administered in a tender part of the body, is very serious, exceedingly painful, and even dangerous.

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WATER-IMMERSION OBJECTIVES

I WISH to call the attention of those biologists who use the microscope to the value of the much neglected water-immersion objective. Its inferiority to the oil-immersion in the matter of numerical aperture, and consequently in power of resolution, has led many microscop-

ists to lose sight of its peculiar advantages for certain kinds of work. The lower angular aperture obtainable with water contact as compared with cedar oil, is compensated for in several ways: first, it gives a longer working distance, due to the necessarily narrower angle of illumination,—a very important thing in high magnification. Second, it gives correspondingly better penetration of the object examined. Third, there is the ease with which both the slide (*i. e.*, the object) and the objective are cleaned. A bit of blotting-paper touched to the objective and the slide is all that is necessary and the mount is ready for further examination with lower magnification. But with an oil-immersion the oil must be first removed before a clear image can be had with lower powers, and this takes time and skill. In fact, if the mount is a temporary one and the cover-glass not held in place by a cement ring or hardened balsam, the cleaning is no job for a careless man. Fourth, where the mount is in water the water-immersion objective is free from the annoying habit of dragging the cover-glass over the specimen when the slide is moved,—a fault of the oil-immersion due to the greater viscosity of the oil connecting objective and cover-glass over that of the water connecting cover-glass and slide. In freshly studied marine mounts this is a big item. Finally the lower cost of the water-immersion objective is a factor well worth consideration.

It should be added, where oil contact between substage condenser and slide is omittted, a very frequent oversight with microscopists, the superiority of resolution of an oil-immersion objective, due to its greater N. A., is lost and the difference between it and a water-immersion disappears.

The only excuse for any immersion objective is that very high magnification and resolution are impracticable with dry objectives because of the working distance and the angle of illumination involved. For this reason it seems to me there is little excuse for immersion objectives below the one twelfth inch English scale or the 2 to 1.8 mm. standard scale.

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QUOTATIONS

HEALTH ORGANIZATION OF THE LEAGUE OF NATIONS

An important branch of the work of the League of Nations is that of its health organization. The International Health Conference which was held in London in April, 1920, declared that the epidemic situation was menacing to all Europe, and that the task of fighting epidemics was beyond the strength of voluntary associations. The conference urged, therefore, that the task should be entrusted to the League of Nations as the only official international organization with sufficient authority and power to undertake the work. In accordance with this recommendation an Epidemics Commission was set up by the Council of the League, and since the end of 1920 this commission has cooperated with the Polish health authorities in their campaign against epidemics. The commission, at the head of which was Dr. Norman White, formerly sanitary commissioner with the government of India, had complete autonomy, but was responsible to the Council of the League. The funds placed at its disposal by the governments which are members of the league were not large enough to make possible an anti-epidemic campaign on the scale originally planned, so the commission began its work in Poland, and delivered to the Polish health authorities the motor transport, soap, clothing, medical stores, etc., most needed at the outset of the campaign; it also provided funds for the repair and equipment of bathing and disinfecting establishments, quarantine stations, and hospitals, and gave fifty complete fifty-bed hospital units. The work of this commission was the first experiment in international sanitary cooperation on a large scale, and it has been a success. Last autumn, however, the epidemic situation in Russia, and the consequent danger to her western neighbors, became greatly aggravated on account of the famine, and more drastic measures were found necessary to deal with the situation. An all-European anti-epidemic conference was therefore convened by Poland at Warsaw, with the approval of the Council of the League of Nations, and twenty-seven different nations took part. It was notable as being the first general

European conference in which Soviet Russia and Soviet Ukraine were represented. The conference drew up a general report of the situation, and the lines were laid down for a series of sanitary conventions, which are now being negotiated between the states of central and eastern Europe as a first defence against epidemics. Finally, the conference prepared a detailed plan for an anti-epidemic campaign in Russia and in the border states, and recommended that the conduct of this campaign should be entrusted to the League of Nations health organization and the epidemics commission. The conference requested the Council of the League to transmit its recommendations to the Genoa conference, on the ground that the latter was to deal with the economic reconstruction of Europe, and because an epidemic campaign in eastern Europe was in its opinion the indispensable preliminary to the work of economic reconstruction. It is hoped that the Genoa conference will deeide upon the measures to be taken with reference to the anti-epidemic campaign, and whether they shall be carried out by the health organization of the League of Nations. This health organization consists of, first, a committee appointed by the Council of the League, which acts as the executive body of the organization; second, the Office National d'Hygiène Publique in Paris, a body in existence before the war, which, though not a League organization, acts in close cooperation with the latter, and in practice serves as its general committee, drawing up draft conventions and laying down general lines of policy; third, a secretariat, which forms the health section of the Secretariat-general of the League. The epidemics commission—originally, as has been said, an independent body—is now also attached to the health section, and is therefore really a part of the health organization. An epidemiological intelligence service has been organized to keep the health authorities of all nations informed as to the incidence of epidemic diseases, and a monthly bulletin is being issued containing statistics and charts of the incidence all over the world of cholera, typhus, dysentery, small-pox, and other infectious diseases. Another branch of the work of the health organization was the conference held in London in December, 1921, on the standardization of serums and serological tests, when, as reported at the time, a program of inquiry and research was elaborated, to be carried out by the various laboratories and centralized in the Copenhagen Institute. The results will be examined at a forthcoming conference to be held at the Pasteur Institute in Paris.—*The British Medical Journal.*

SPECIAL ARTICLES

THE DOMESTIC FOWL AS A SOURCE OF IMMUNE HEMOLYTIC SERA

DURING the last three years we have obtained abundant evidence which refutes Citron's[1] claim that the chicken is one of the best adapted animals for the production of hemolytic sera. Citron gave no evidence to justify the inclusion of the domestic fowl among the species best adapted to produce hemolytic sera and so far as known to me, none exists. In point of fact, we find this animal one of the poorest hemolysin producers that has come within our experience.

It was known to Bordet[2], Sachs[3], Metchnikoff[4], and P. Müller[5] long before the appearance of Citron's book, that a difficulty was involved in demonstrating the sensitizer or amboceptor content of the serum of this animal[6], and Citron's unsupported claim should have been regarded with suspicion. In spite of this fact, the statement from Citron is still taken at its face value. Thus, Guyer and Smith[7] have recently made

[1] Citron, J., 1912, *Immunity.* Translation by A. L. Garbat.

[2] Bordet, J., 1899, "Agglutination et dissolution des globules rouges," *Ann. de l'Inst. Pasteur,* 13: 273.

[3] Sachs, Hans, 1902, *Berl. klin Wochen,* Nos. 9 and 10.

[4] Metchnikoff, E., 1907, *Immunity in infective Diseases,* Cambridge Press.

[5] Müller, P., 1901, *Uber Anti-hämolysine Centralbl. f. Bakt. u. Parasitenkunde,* 29: 175.

[6] Hyde, R. R., 1921, "The reactivation of the natural hemolytic antibody in chicken serum," *Am. J. Hygiene,* 1: 358-362.

[7] Guyer, M. F., and Smith, E. A., 1918, "Some prenatal effects of lens antibodies," *J. Exper. Zool.,* 26: 65-82.—1920, "Transmission of induced eye defects," *Ibid.,* 171-215.

use of it in support of their contention of having produced in the chicken a serum lytic for the eye lens of the rabbit, with which results of great biological significance were obtained.

The serum of chickens which had been treated with rabbit lens was injected into the circulation of pregnant rabbits. A few of the young of these rabbits had an eye defect which was passed on to succeeding generations. It was contended that the eye defect was in all probability due to the cytolytic action of the chicken serum since chickens are known to be good cytolysin (hemolysin) producers.

We have treated chickens with the red corpuscles from a number of animal species. In no case was any marked increase in the lytic properties of the serum from the treated birds evident. It was found in fact that fresh chicken serum renders rabbit corpuscles nonantigenic for guinea pigs, which accounts for the failure to produce any marked increase in the sensitizer content of the chicken.

In the light of our observation on the production of hemolysins in the chicken, it seems improbable that Guyer and Smith produced in this species a serum lytic for the eye lens of the rabbit. At least the conclusion that cytolysins must have been formed in the chickens treated with the rabbit lenses because of the readiness with which this species produces cytolytic sera, is not tenable.

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THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

TUCSON MEETING OF THE SOUTHWESTERN DIVISION

THE second annual meeting of the Southwestern Division of the American Association for the Advancement of Science was held at the University of Arizona on Thursday, Friday and Saturday, January 26, 27 and 28, 1922. The meeting was opened by President A. E. Douglass in the chair, who, after a welcome and announcements, proceeded with the papers of the physical science section in open meeting. These were followed by biological papers in the afternoon. In the evening the president's address was given upon the subject, "Some aspects of the use of annual rings of trees in the study of climate." This meeting constituted the formal opening, with addresses of welcome from the acting mayor of Tucson, the president of the Chamber of Commerce, and the acting president of the university. These were responded to by Dr. E. C. Prentiss, the chairman of the executive committee of the Southwestern Division, who was followed by Dr. D. T. MacDougal, introducing the speaker of the evening. This address was followed by the reception to the visiting members given by the Faculty Club of the University of Arizona.

On Friday morning a special reception was given to Señor Ing. Ignacio Salas and his secretary, Señor H. Irigoyen, representatives of the minister of public works of the Mexican government. These guests were introduced by Dr. D. T. MacDougal, general secretary of the American Association. They responded by speeches in Spanish and in English.

The papers of Friday morning dealt with the social sciences, including history and archeology.

The biological papers were continued at 1:45 P.M., and at 2:45 Dr. Henry B. Ward, of the University of Illinois, gave a lecture entitled "The struggle between man and wild life in North America" before a joint meeting of the Sigma Xi Club of the University of Arizona with the Southwestern Division, to which also a special invitation had been extended to the Pima County Teachers' Institute then in session. This was followed by a trip about the campus of the university with visits to the observatory, engineering, physics and research exhibits, and the museum. In the evening Dr. Edgar L. Hewett of Santa Fe gave an illustrated lecture upon "Native American artists" to a joint meeting of the Arizona Archeological and Historical Society with the Southwestern Division. This was followed by a reception in the museum and an exhibit of wireless telephone.

On Saturday morning the three sections were in session simultaneously throughout the morning, except that at 11 o'clock a business meeting was held in which Dr. D. T. MacDougal was elected president of the division for the coming year, and Dr. A. E. Douglass was elected a member of the executive committee. A Yaqui Indian dance was presented in the Yaqui village near Tucson from 2 to 4 in the afternoon, followed by visits

to the Desert Laboratory of the Carnegie Institution and to the Mission of San Xavier near Tucson.

The visiting members were entertained at lunch by the University of Arizona on Thursday in the new Maricopa Hall. They were also entertained at lunch on Friday by the Tucson Chamber of Commerce, at which the Mexican representatives and Dr. Ward were introduced and made addresses.

On Thursday evening a Sigma Xi banquet was held with Dr. Ward and the Mexican representatives as guests of honor.

The executive committee met each morning at 9 and held its final session on Saturday morning. Resolutions were passed in favor of the limitation of the use of radium in the form of radiolite. The next meeting was decided to be held in Santa Fe, New Mexico, September 11-14, 1922.

In arranging the program of this Tucson meeting the special effort was made to give to each section a certain amount of exclusive time during which its papers of widest interest could be presented. This was followed by simultaneous meetings of the sections at which the more technical papers were given, thus assuring abundant time for all papers. The program had been prepared by Dr. V. M. Slipher, chairman of the physical science section, Dr. C. T. Vorhies, chairman of the biological science section, and Dr. E. L. Hewett, chairman of the social science section in conjunction with the president.

On January 29 an ecological excursion was made to the Tucson mountains and lunch was served near the petrified trees, recently discovered by Dr. Sarle, of the University of Arizona.

ABSTRACTS

Chemistry

Flagstaffite, a new Arizona mineral, and its identity with terpin hydrate: F. N. GUILD. Dr. A. E. Douglass discovered on buried logs near Flagstaff, Arizona, a finely crystallized substance whose chemical and crystallographic analysis resulted in its determination as a new organic mineral with the formula $C_{10}H_{22}O_3$. This was named Flagstaffite. Afterwards a communication from Dr. Francis Dodge of Brooklyn led to the further conclusion that flagstaffite is identical with terpin hydrate, a substance easily synthesized in the laboratory, but hitherto never found occurring naturally. The author emphasizes the importance in chemical research of accurate crystallographic measurements, pointing out that in this case, the identity of flagstaffite with terpin hydrate was established largely through crystallographic data.

Demonstration of the Goldschmidt crystal model machine: F. N. GUILD.

The ionization of strong electrolytes in the light of recent theory: T. F. BUEHRER. The author sets forth that an explanation of the anomaly of strong electrolytes as evidenced by their failure to obey the Ostwald dilution law must be sought for in the arrangement of electrons within the molecule, according to the Lewis theory of molecular structure. It also demands a more rational definition of the idea of dissociation of an electrolyte. Various tables showing the activity-coefficients and ionization-constants of potassium chloride, a typically strong electrolyte, and acetic acid, a typically weak one, were given for illustration.

Critical solution temperatures of white phosphorus: T. F. BUEHRER. The theory of solubility worked out by Professor Hildebrand of the University of California is discussed and illustrated by a table, showing the varying conditions of solutions of white phosphorus in different substances.

The development of the tungsten lamp: PAUL CLOKE.

Some new beryllium alloys; their preparation and properties: M. G. FOWLER. Beryllium is a rare element and difficult to separate from Al. It resembles Al, but is lighter and has greater tensile strength. Experimenting on methods of preparation, it was first attempted to electrolyze beryllium into molten lead from fused BeF_2NaF; and then into mercury from an aqueous solution. In the first case, beryllium was found to be sparingly soluble in lead; and in the second case the amalgam was readily decomposed by water. However, since a pure alloy of beryllium was required, electrolysis was abandoned as unsuccessful. Then oxides of copper and beryllium were reduced in the electric furnace and an alloy containing considerable carbide was obtained, and a similar reduction of BeF_2 with an excess of magnesium produced an alloy of Be and Mg. This method promises more success. The intention is to study phase rule diagrams of alloys of beryllium with copper, aluminum, magnesium, cadmium and zinc.

The potential of the gold electrode: F. S. WARTMAN. The present values of the potential of the gold electrode—the measure of its tendency to pass from the metallic to the ionized condition—are found in error, due to the effects of variations in the physical form of the metal, temperatures and solutions of very soluble salts used by previous investigators. The present work

undertakes to eliminate these sources of error by the measurement of the cells:

(1) Au, AuCl, KCl, (XM), AgCl, Ag.

(2) Au, AuCl, HCl (XM), H_2 (1 atom.)

The direct value obtained for the second cell will be checked by an indirect method which employs Cell (1). Cells employing Au_2O in KOH solution are also being measured.

A study of some unusual habits of wulfenite: F. S. WARTMAN. This paper briefly discussed an extremely flat third order pyramid found to be somewhat common on wulfenite crystals in the Southwest. It is characteristic, although its symbol varies from 1-7-75 to 1-7-98. Another unusual crystal having the prism faces well developed was also described.

A study of the catalytic effect of metallic copper upon the evolution of hydrogen from acids by base metals: DOROTHY G. ANDREWS.

Geology

Sketch of the geology of the Dos Cabezas Mountains of southwestern Arizona: C. J. SARLE. The range is described as a homoclinal fault-block structure, dipping southwestward, with northwest-southeast trend, about 25 miles long, with greatest width midway of nearly 10 miles and maximum height of approximately 8,300 feet in the centrally situated twin peaks from which it takes its name. Residuary piedmont gravel slopes incline away from the range to the broad waste-filled Sulphur Springs valley on the southwest, and to the similar San Simon valley on the northeast. The Dos Cabezas range forms a common orogenic structure with the larger Chiricahuas to the south. The relations and character of the formations and structures reveal a history extending back, possibly to Archean time, and seem to show four periods of mountain making; two pre-Cambrian, and distinctly batholithic; one at the close of the Paleozoic, of marked warping, and possibly with faulting; and a fourth of marked volcanicity and profound faulting, with some batholithic intrusion. The last produced the present Dos Cabezas range. The first three were followed by planation and subsequent sedimentation. Tertiary erosion developed a rock pediment and piedmont gravel slopes, mature dissection extending to the heart of the range. In turn Pleistocene erosion deeply sculptured the piedmont area. The sedimentaries include a heavy, pre-Cambrian quartzite, Cambrian including an upper limestone member, Ordovician (Beekmantonian), Mississippian, Pennsylvanian, Comanchean (with marine leaf), Tertiary piedmont gravels and recent alluvials (fan and stream flat deposits). (Preliminary and with permission of the director of the Arizona Bureau of Mines).

Astronomy

The application of spectrum analysis to studies of the planets: V. M. SLIPHER. A discussion of the use of the spectroscope in studying rotation and motion of the plants and the constitution of their atmospheres. Evidence of water vapor in the atmosphere of Mars was presented.

Martian polar rifts: G. H. HAMILTON. A discussion of rifts in the polar cap of Mars, observed during the successive oppositions of 1916, 1918 and 1920; and accompanied by lantern slides of drawings illustrating rifts. The belief was expressed that these rifts confirm Lowell's contention that there is vegetation on Mars, since it is assumed that they are caused by the heat given off from growing vegetation. This conclusion is drawn from the apparent similar condition produced on the earth by vegetation growing under the snow.

Methods used at the Lowell Observatory in studying Mars and other planets: E. C. SLIPHER. The technique of astronomical photography was explained. The necessity for enlarging the image, correcting for chromatism with the yellow filter, and using specially sensitized plates was pointed out. The speaker also discussed the time exposure necessary, which varies from one third of a second to 25 or 30 seconds. In closing, it was declared that if due allowance be made for the limitations of the two methods, each is useful as a check on the other.

Progress in photographic observations of nebulæ with the 40 inch Lowell reflector: C. O. LAMPLAND. The modern telescope has increased greatly the number of stars and nebulæ, and dark nebulæ have also been identified. Among astronomers considerable difference of opinion exists as to the depth of our stellar galaxy, some placing its greatest diameter at 300,000 light years; others at about one fifth of that. It was pointed out that spiral nebulæ may be stellar systems—island universes—outside our own galaxy. Various arguments for and against the "Island Universe" theory were offered, among the former being the discovery by V. M. Slipher in 1912 of high space velocity and axial rotation. Yet, despite these high space velocities, their proper motion is very small. Also, their spectrum differs from the spectra of the stars in our system, it resembling the coalesced light of many stars at such great distances that the light of one star can not be dis-

tinguished from the others. An argument against the Island Universe theory was drawn from a series of photographs of a spiral nebula, taken over a space of five years and showing marked changes in the nebula from year to year. It was argued that changes in a whole universe so marked as to be plainly visible at such enormous distances, and occurring within the time space of five years, would be very extraordinary. A similar argument was found in the prominence of the central star in spirals.

A recording micrometer: A. E. DOUGLASS. A description and demonstration of a portable micrometer, which records its readings directly to scale on cross section paper. This instrument was developed in connection with researches on the rings of trees and their relation to climatic cycles, but can be used equally in telescopes.

The spectrum of the night sky and of the aurora of May 14, 1921: V. M. SLIPHER. In observations made by the author, the auroral line is easily determined in the spectrum of the night sky. It shows up at Flagstaff even on cloudy nights. Careful observations made there determined the wave length of the auroral line to be 55.78 instead of 55.71, the previously accepted value. This new value shows a further departure from any known substance than does the old. The auroral line shows in the spectrum, no matter what part of the heavens the camera is pointed at; it is, however, weakest near the zenith. Lord Rayleigh, the great English scientist, is now at work upon this problem of the auroral line in the spectrum, the object of this study being to gain additional information concerning the upper limits of the earth's atmosphere. The work of Dr. Stuerman, a Norwegian scientist, who has spent many years in the study of auroral phenomena, shows that most of the auroral streamers take place about 100 kilometers above the earth's surface, but some are as high as 500 kilometers. If we can learn what the auroral line corresponds to, our knowledge of the upper limits of the earth's atmosphere will be greatly increased. The author showed many photographs taken with a hand camera, of the remarkable auroral display of May 14, 1921, the most brilliant ever noted at the Lowell Observatory.

Observations on the magnetic storm of May 14, 1921: WILLIAM CULLOM. Mr. Cullom described briefly the U. S. Magnetic Observatory and the appliances used, noting especially the variometers which records the horizontal and vertical intensity of the earth's magnetic field. He discussed quiet days—or days of normal magnetic activity—and disturbed days—or days of magnetic disturbance; and exhibited a typical variometer record of each. He described how the great magnetic storm of May 14, 1921, was preceded by a violent preliminary disturbance and the storm proper was divided into three phases—one from 6 P. M., May 13, to 4 A. M., May 14; another from 3 P. M., May 14, to 2 A. M., May 16; and the third from 3 P. M., May 16, to 5 A. M., May 17. The two last were about equal in violence; the first was less violent than the other two.

Report of a daylight meteor seen in Prescott, Arizona: MILTON UPDEGRAFF. The author mentioned a report which reached him in the spring of 1921 of a meteor which passed over Prescott from the east to the west, and of such brilliancy that it was plainly visible about noon. He himself did not see it, but was told of it by several reliable people. Later reports reached him which led him to believe that the meteor struck in the neighborhood of the Harcuvar Mountains, in Mohave County, somewhat southwest of Prescott, and 30 or 40 miles from the California line. He mentioned the advisability of having a search made of that region, to try to find some traces of the meteor on the place where it struck.

Biological

The preservation of natural areas in the national forests: G. A. PEARSON. The writer was requested by the chairman of the Committee of Preservation of Natural Areas of the Ecological Society to list the areas of the national forests of Arizona and New Mexico where plant and animal life and natural features in general may remain undisturbed by human activities. Within these two states are 15 natural forests whose combined area is nearly 22 million acres. Under the existing methods of management it is interesting to consider whether the national forests will answer the requirements for "natural areas." The general policy governing the handling of national forests is that of highest use to the public. The primary purpose is the production of timber and associated with this is the utilization and development of grazing, agriculture, water, mining, recreation and other resources. One or two areas, even though of large size, would probably not represent a sufficient variety of conditions to satisfy foresters and botanists. Their needs could be met by selecting small supplementary areas of from 80 to 640 acres.

The relation of research to agriculture: D. W. WORKING. A reaffirmation of the necessity for

research in agriculture looking toward increased production even at the present time when there seems to be an overproduction along many lines; but also, a plea that agricultural research workers broaden the field of their endeavor, and work out new methods of farm management and marketing, in order to enable farmers to dispose of their products more readily and at a fair profit.

A study of the grasses of Arizona: J. J. THORNBER. This paper includes a study of the 260 species of grasses of Arizona with comparisons of the grass floras of New Mexico and Colorado. The grasses of northern and southern Arizona were compared in numbers, species and the origin of species, typical species of these two grass floras being noted. The grass flora of Arizona was stated to consist of 55 per cent. of southern and southwestern species, 25 per cent. of northern species and 20 per cent. of introduced species. The largest genera of grasses in Arizona in order of number of species are as follows: Muhlenbergia, 23; Panicum, 19; Bromus, 19; Bouteloua, 14; Sporobolus, 12; Aristida, 10.

Forces concerned in the enlargement of cells during growth: A new artificial cell: D. T. MACDOUGAL. The protoplast in its earlier stages is a solid cylindrical or globoid mass of jellies. Enlargement or growth in this stage is by the addition of new material and its swelling by the imbibition of water, which constitutes growth by *accretion*. The formation of cavities or vacuoles in the protoplasm filled with substances which attract water sets up osmosis which pulls in additional water and causes a stretching or enlargement of the entire mass, which is designated as growth by *distension*. The protoplasmic mass was described as including all substances in the cell which may take the form of a reversible gel, that is, which liquefies or dissolves in water or by heat, and which sets or solidifies at low temperatures or on dehydration.

The course of growth of potato tubers: D. T. MACDOUGAL. The growth of potato tubers has been followed in 22 examples measured at Carmel, California, by means of the auxograph. A diagram exhibited showed the course of enlargement of the tuber during its development which might cover a period of 60 to 80 days. The highest rate of enlargement of diameter of the tuber was in its earliest stages when it was less than one cm. in diameter. The highest rate of increase in volume, however, ensued at a much later stage, when the tuber had reached perhaps three fourths of its final size.

An ecological system of plant relationships: EDITH CLEMENTS. This is an account of the application of ecological principles to the evolution of flowering plants, as exemplified in the Besseyan system. The evolutionary processes are assumed to be insect-pollination and wind-pollination, and to have brought about fundamentally similar results by divergent methods.

Changes of climate and life in the Southwest: FREDERIC E. CLEMENTS. A comprehensive attack upon the problems of climatic cycles in the Southwest has disclosed a large amount of evidence drawn from various sources. The most direct evidence has been obtained from weather records of rainfall, in following up the clue afforded by Douglass's studies of tree rings in this region. The operation of larger cycles is indicated in land-forms, such as shore-lines, bajadas and dunes, but is seen with especial clearness in vegetation. This is particularly true of the Mohave Desert and the Santa Cruz valley at Tucson, in both of which grassland communities exhibit cyclic changes in harmony with those found elsewhere in the West.

An improved form of the quadratograph: GORM LOFTFIELD. The Hill quadrat pantagraph has been greatly improved in the past year. These modifications are described, and the apparatus demonstrated. In addition, the present system of staking and photographing quadrats is discussed briefly.

Influence of texture on the limit for black alkali: C. N. CATLIN. Wheat, barley, milo maize and hegari were grown in soil so compounded from actual field soils as to contain 0.20 per cent. sodium carbonate, the only variable being texture, which ranged from heavy clay to high sand. A table of weights of crops shows the maximum growth in the finer textured soils at this "black alkali" concentration.

The effect of intercultural practices on temperatures and humidity in citrus orchards: F. J. CRIDER. Comparative meteorological data obtained from adjoining cover-cropped and cleanly cultivated citrus orchards in the Salt River Valley of Arizona showed that the mean soil temperature of the cover-cropped orchard one foot below the surface was two degrees higher during winter and eight degrees lower during summer than the cleanly cultivated orchard. It was further shown that the mean minimum atmospheric temperature of the cover-cropped orchard was three degrees lower during winter, and the mean maximum

atmospheric temperature seven degrees lower in summer than the cleanly cultivated orchard. Humidity and evaporation records revealed equally valuable data in that the humidity of the cover-cropped orchard for a period of six months was 12.44 per cent. greater and the evaporation 33 per cent. less than the cleanly cultivated orchard. These temperature, humidity and evaporation relationships have a distinct economic bearing in suggesting the avoidance of cover crops in citrus orchards during winter as a means of preventing cold injury, and in indicating the value of such crops in equalizing the environmental factors of the citrus plant.

Physical and chemical factors in the growth of asparagus: E. B. WORKING. Observations on the great asparagus plantations of the Sacramento islands were brought to bear on the particular problems being studied. Charts shown included growth curves illustrating particularly the relation of temperature to growth rate. Reactions to chemical environment, as indicated by hydrations under the MacDougal precision auxograph, were discussed.

Distribution of Arizona wild cotton (Thurberia thespesioides): H. C. HANSON. A summary of all information on distribution and abundance of the wild cotton and the wild boll weevil. Present knowledge shown to be inadequate. (Paper will be published as a bulletin of the Agricultural Experiment Station of the University of Arizona.)

The native wild cotton bollworm, Thurberiphaga catalina Dyar, and its relation to cotton cultivation: C. T. VORHIES. The Thurberia bollworm is the larva of a native noctuid moth, recently described, and known only in Arizona wild cotton, *Thurberia thespesioides*. In its larval stages it is a destructive bollworm of wild cotton. A study of its life history now in progress has shown that it can complete its larval life in the bolls of cultivated cotton and it is therefore a potential pest of that crop. Further observations will be made to determine its adaptability to field conditions of cultivated and irrigated land. Restriction of cotton cultivation to areas non-adjacent to wild cotton is a desirable precaution.

Some observations of alfalfa girdle: FREDERICK GIBSON. A disease of economic importance to alfalfa growers of the Southwest, which was first noticed and recorded in 1909, by Freeman and McCallum. No description of symptoms have been previously published. Osborn mentions a girdle of alfalfa, due to a Membracid (*Stictocephala sp.*). The complete paper with illustrations has been accepted by the Phytopathology publishers and will soon be distributed.

The use of cat tail (Typha latifolia) as a feed: L. E. FREUDENTHAL. In a feeding experiment with forty Duroc-Jersey pigs the writer demonstrated on his own farm that cat-tail (*Typha latifolia*) is a satisfactory feed. Its feed value, composition and possible economic importance are discussed.

Suppression of molds during the incubation of certain parasitic fungi: R. A. STUDHALTER. The suppression of molds during the incubation in a saturated atmosphere of certain parasitic fungi in vitro may be accomplished by treating with certain chemicals. Powdered sulphur, various concentrations of mercuric chloride, formaldehyde and copper sulphate, and the use of a dry atmosphere are effective during the incubation of *Pestalozzia sp.* on the needles of *Pinus radiata*, particularly if the chemicals are applied after one to four days of presoaking of the infected needles in water. In the controls the molds appeared to the unaided eye more than five days before the *Pestalozzia* tendrils were pushed through the ostioles; after the treatments mentioned, this advantage of the molds was reduced, the tendrils appearing after some of them from one to five days before the molds. The mycelial growth of the molds was also retarded to a greater extent than was the development of the *Pestalozzia*. No chemical or treatment was found which is able to suppress the molds without seriously hindering the proper development of *Lophodermium sp.* on the needles of *Pinus radiata*, in part probably because the open and more exposed fruiting body of this fungus permits the easy and rapid penetration of toxic agents.

An undescribed fungus on the pepper tree: J. G. BROWN. The pepper tree (*Schinus molle*) grown as an ornamental in the warmer parts of the Southwest, is attacked by a fungus which causes extensive rotting of the wood, eventually resulting in death. Symptoms are gradual death of the branches, or sudden death of the entire tree preceded by wilting. The latter symptom is likely to occur during the hot dry summer months. It is due to the growth of the mycelial hyphæ in the tracheæ. In the case of gradual death of the branches, sporophores appear on the trunk or on branches during the summer rainy season. The sporophores are bracket-like, brown to almost black, azonate, annual, and they usually have a maximum breadth of 12 to 15 cm. The pores are hexagonal to subcircular, occasionally

elongate. The context is brown and is continued into the trama unchanged. Spores are light-brown, oval. The name *Inonotus Schini n. sp.* is proposed. The infection results from frost and wind storm injury and from improper pruning methods. Histological studies indicate that the fungus has few if any new features in connection with the development of the club and the basidiospores.

Some aspects of the use of the annual rings of trees in climatic study: A. E. DOUGLASS. The ring is primarily a climatic effect. Surplus rings, which are rare, come from too great seasonal emphasis. Missing rings come mostly from excessive dryness of climate. These errors are readily located by comparing many trees together from the same region. The number of trees so far used is about 450 and the number of rings whose date of growth has been identified is over 100,000. The sequoias of California carry an excellent record for more than 3,200 years. The growth of dry climate trees depends on the topography which controls their water supply. Automatic measuring instruments and an analyzing instrument have been constructed. In dry climates the trees show variations which match the rainfall with remarkable exactness. In certain wet climates they show variation that corresponds to the solar activity as denoted by the number of sunspots. The sunspot cycle of 11 years is very common, together with its multiples, 22 and 33 years. The rings of trees are now giving us important information in the chronology of the prehistoric ruins of the Southwest.

The life history of a pine tree as read from a longitudinally bisected trunk: FORREST SHREVE. A vigorous individual of *Pinus radiata* 38 years of age was felled and the trunk cut away so as to expose a median longitudinal section. Transverse sections were taken at intervals of one meter. The annual rings were then identified and dated in each cross section, using the longitudinal surfaces to confirm the dating. Measurements of the individual rings were made at each of the transverse sections, showing a very considerable irregularity in the thickness of the layer of wood laid on in any one year at different heights on the trunk. The period of most rapid growth in height and diameter was between the ages of 7 and 14 years and between the heights of 3 and 8 meters. There is a tendency for the growth in diameter to be greater toward the top of the tree than toward the base. There was a marked slackening in growth rate after the thirty-fourth year. Double rings of growth are frequently formed in a single year, due to the resumption of growth in the autumn, and they can usually be readily distinguished from the growth rings of successive years. The autumnal thickening also varies with height and is sometimes recognizable at certain heights and apparently absent at others. The results indicate that in *Pinus radiata* a true measure of the annual growth performances should be based on several cross sections at different heights and not on data from the stump section alone.

Effect of tree transpiration on the groundwater table: G. E. P. SMITH. Some efforts made primarily to determine output of groundwater supply through transpiration seems to offer a new method of learning much concerning the quantity and character of transpiration of phreatophytes. Output method of measuring safe annual yield of groundwater useless without knowledge of transpiration of forests and botanical literature silent on this subject. Investigations began in 1916 but discontinued until 1921. Full year's record in 1921 in mesquite forest and in cottonwood forest. Well pits excavated in selected locations and equipped with water-stage recorders of two types. Movements of water table in winter very slight, but correlate closely with daily barometric cycle and with approach and departure of storms. Budding period shows little effect but, after leaves start, draught on groundwater very pronounced. Daily cycles in fair weather uniform, and of two parts—the daily transpiration curve and nocturnal recharge curve, with very little lag. Effects of cloudiness, rains, warm evenings and other conditions plainly marked. Transpiration from mesquite forest almost ceased in August due to disease of trees which caused defoliation, but became rapid again in October after growth of new leaves.

Changes in the composition of Salton Sea with an interpretation: A. E. VINSON. The series of annual analyses showed that $CaCO_3$ had not concentrated as rapidly as total solids. This loss took place as a deposition of tufa. Phosphorus practically disappeared from the water and an analysis of the tufa showed that this may have been deposited with the tufa. Potassium has not concentrated as rapidly as sodium but the potassium in the tufa would account for not over three per cent. of that lost. The conclusions drawn are that most of the potassium had been absorbed in the heavy mud deposits to be seen on the shores.

Medical

Observations on non-surgical drainage of the liver and gall-bladder: ELLIOTT C. PRENTISS. The emptying of the liver and gall-bladder by means of the duodenal tube, whose tip is at, or just below, the papilla duodenalis, after a solution of $MgSO_4$ has been injected into the duodenum, is the subject dealt with in this paper. The Refuss tip is used, as it is heavy enough to drag the tube to the pylorus after insertion into the stomach, and the openings in it are large and well placed. It is easily swallowed and requires an average of one to one and one half hours to pass into the duodenum. Condition of patient causes some variations in this time interval and passage in some cases is impossible. With tube in position run in 15 per cent. to 30 per cent. $MgSO_4$, using one ounce at a time, and allow to remain five minutes. Therapeutic results are satisfactory in conditions such as chronic cholecystitis even when gall stones are undoubtedly present. Valuable for treatment of gall-bladder infections—such infections as usually progress to formation of gall stones and other complications ultimately requiring operations. Thus, by repeated drainage of liver, cures are frequently obtained and many operations prevented.

The cause of hay fever in Arizona and the Southwest: DR. SAMUEL H. WATSON and DR. CHARLES S. KIBLER. This paper presents the results of the first research work ever done as to the cause of this disease in this section of the country—a complete list of all the plants which grow here, that can possibly cause the disease, is given, and the relative importance of the various plants as a cause is indicated.

Radium, its actions on human tissue cells: W. WARNER WATKINS. The discovery of, and developments in connection with, radium, represent one of the best illustrations of cooperative work of different branches of science. In these branches the applications of radium by the medical sciences is the most interesting. To understand radioactivity, the fundamental structure of the atom must be borne in mind and the phenomenon of ionization. Of the different particles discharged by disintegration of radium atoms, the alpha particle, which is a positively charged helium atom nucleus, has limited application in medicine, since its penetration into the tissues is so slight; the beta particle, which is a negatively charged electron, is usually filtered out when radium is used biologically, because the gamma ray, which is a very short wave light ray, is exceedingly penetrating, and ionizes the atoms of the tissue molecules, producing beta rays which are the real therapeutic rays in radium treatments. Radium may be used either to destroy foreign growths in the body tissue, or, by limiting its application, to stimulate the normal cells of glands of the body. This latter effect will, eventually, be the important field of application of radium.

The supply of radium: ARTHUR L. FLAGG. The principal sources of radium are from the ores of carnotite and pitchblende. The carnotite ores of the United States are the largest known deposits of uranium-bearing ores. The carnotite occurs in sandstone as grains or incrustations, usually in irregular lenticular masses which are mined by simple methods. The sorting of the ores entails much waste which can be eliminated with proper care. The total production of elemental radium in the United States since 1913 amounts to about 184.9 grams. Much of this has been exported and a too large amount used as an illuminant on cheap watches and other novelties of short useful life. Mesothorium is a valuable and practicable substitute for radium in making luminous paints and its use should be encouraged in order to conserve the radium for its more legitimate uses in therapeutics and in scientific research.

Archeology and Anthropology

Discovery of three skeletons of the Hohokam race in southern Arizona, a prehistoric desert people of the Southwest: C. J. SARLE. Three human skeletons were recently found near Tucson, buried face down, without reference to direction and without personal belongings, which seem from their associations to be referable to a prehistoric people designated Hohokam by Russell (1905). That the grounds for this reference may be understood the paper describes the culture of these ancient people, stating in substance that they were pueblo dwellers, agricultural, and weavers. The pueblos were built of clay and wattle and often included large community houses. This people cleared land and tilled the soil, wove, used edged stone implements, mainly eolithic in simplicity (little modified by secondary flaking), and were excellent potters, decorating their ware with colored designs which exhibit a high degree of artistic skill. They etched the numerous pictographs so common on rock surfaces near the village sites, and seem to have adhered closely to the practice of cremation, a fact